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CLEAR RIVER STUDY AREA

WATER RESOURCE MANAGEMENT

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CLEAR RIVER STUDY AREA
WATER RESOURCE MANAGEMENT

Prepared For

Land Use Assignment Committee
Department of Lands and Forests
alberta

By

Water Resources Division
Alberta Department of Agriculture

Edmonton, Alberta
March, 1971

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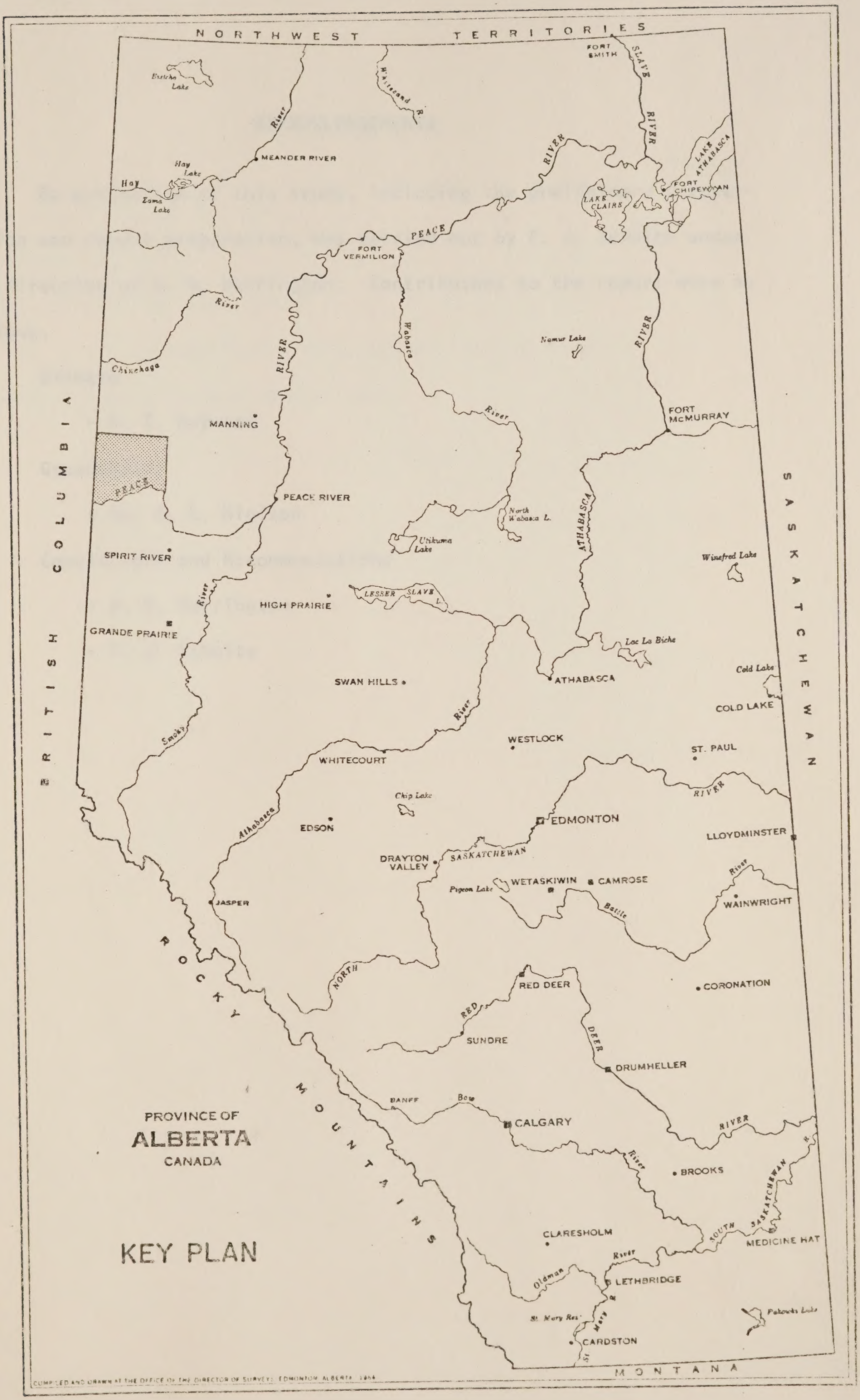
CLEAR RIVER STUDY AREA
WATER RESOURCE MANAGEMENT

Prepared For

Land Use Assignment Committee
Department of Lands and Forests

Submitted By:

R. E. Bailey
Director
Water Resources Division
Department of Agriculture



COMPILED AND DRAWN AT THE OFFICE OF THE DIRECTOR OF SURVEYS, EDMONTON, ALBERTA. 1966

ACKNOWLEDGEMENTS

Co-ordination of this study, including the preliminary investigation and report preparation, was carried out by F. J. Schulte under the direction of D. G. Harrington. Contributors to the report were as follows.

Climate

- R. T. Heywood

Groundwater

- Dr. G. L. Nielsen

Conclusions and Recommendations

- D. G. Harrington
- F. J. Schulte

Table of Contents

Page No.

Agricultural Climate Summary 1

Groundwater Summary 2

Recommendations and Conclusions 2

Appendix A - Detailed Climatic Data and Glossary of Terms

Appendix B - Detailed Groundwater Data.

CLEAR RIVER STUDY AREA

Water Resource Management

The Study Area lies in the area bounded by townships 83 to 88 and ranges 7 to 13 west of the sixth meridian. The Water Resource recommendations are shown on the Water Resource Management map. (see attached map).

Agricultural Climate

The average annual precipitation is 16 inches with 60 percent occurring between May and September. The greatest risk of drought occurs in May and June, when precipitation is variable.

The frost free period (32°F) varies from 90 days to less than 75 days. For feed grain crops, the effective frost free period can be extended since these crops are relatively uneffected by temperatures as low as 28°F.

The index, degree days over 42°F, appears to indicate minimum conditions required for agriculture. Since the study area has longer days than many other areas, degree days over 42°F underestimates conditions.

Agricultural potential of much of this area is good. Feed grains, and forage crops for hay and seed provides the lowest risk of crop loss. Livestock enterprises are considered possible. Wheat can be produced in the southwest corner and other favoured areas with some success. Risk of frost damage in depressional areas and general reduction in all climatic factors in the Clear Hills will limit these areas to pasture and hay production.

Groundwater

This area is one of rather limited groundwater potential. The bedrock formations covering most of the area are marine shales yielding virtually no groundwater. The depth of the Dunvegan Formation is almost beyond economic reach in certain areas, but it generally yields sufficient water for farm use. The Wapiti Formation with yields up to 60 gallons per minute occurs in the upper part of the Clear Hills. However, this formation falls entirely within the watershed protection area.

Recommendations and Conclusions

1. Agricultural potential of much of this area is good. Risk of frost damage in depressional areas and a general reduction in all climatic factors in the Clear Hills will limit these areas to pasture and hay production.
2. The Wapiti Formation with yields up to 60 gallons per minute occurs in the upper reaches of the Clear Hills. However, this formation falls entirely within the watershed protection area. The remainder of the Study Area is essentially dependent on surface runoff for water supply.
3. All land above 2500 feet in elevation has been designated as a protection area. Increased runoff due to clearing in this area would greatly effect the highly erosive marine shales found in the lower areas. The remainder of the protection areas correspond to the river break zones. (see watershed protection map).

THE EFFECT OF CLIMATE ON AGRICULTURE IN THE CLEAR RIVER STUDY AREA

Introduction

Variation in climate is a significant factor in determining agricultural potential in this study area.

Agro - Climates of Alberta[1] indicates four separate agricultural climates. The first climatic type in the southwest corner of the study area is limited to three townships along the Peace River. This area is suited to all the crops common to this area. The frost free period is generally 90 days and precipitation is adequate. The second climatic type covers a strip, two townships wide along the Peace River. This area has adequate precipitation and 75 to 90 frost free days, but frost damage to wheat occurs in 30% of the years. The third climatic type occupies the study area up to the Clear Hills (2500 foot elevation). In this area precipitation is adequate but the frequency of frost makes wheat an impractical crop. The fourth climatic type covers the remainder of the area where the precipitation is adequate, but the short frost free period (less than 60 days) restricts agriculture to hay production.

The Canada Land Inventory[2] has subdivided the area into three types of climate. The first and second climatic types cover the same areas as in the previous classification. The third climatic type covers the remaining part of the study area. Table I indicates the criteria used in this classification.

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[1] W.E. Bowser, and Alberta Soil Survey, Agro-Climates of Alberta, 1967 (map)

[2] L.J. Chapman, and D.M. Brown, The Canada Land Inventory, Report No. 3, 1966 (Page 15).

TABLE I

Climate Classification Criteria

	Climate Type		
	I	II	III
Degree days over 42°F	>1800	<1800	<1800
Frost free days 32°F	75-90	<75	<75
Water deficiency inches	3-5	3-5	0-3
May-September precipitation	10-13	10-13	12-15

Moisture Relationships

The study area receives uniform annual precipitation (16 inches) occurring from May to September. Annual potential evapotranspiration is 18 to 20 inches. Dr. Laycock[3] indicates that the moisture deficit will be less than four inches 1/4 of the time and greater than six inches 1/4 of the time. These deficits are representative of those encountered by alfalfa. Grain crops require only 80% of the moisture required by alfalfa; hence serious moisture deficits for these crops over a season is rare. Serious moisture deficits may still result from poor distribution of precipitation. Table II indicates the percentage of the last ten years in which individual months have had less than two inches of precipitation.

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[3] A.H. Laycock, Water Deficiency and Surplus Patterns in the Prairie Provinces, March 1967. (Fig. 9 and 10).

TABLE II

Percentage of Individual Months with less than two inches of Precipitation[4].

Month	Percentage of months with less than 2 inches of precipitation.
May	82
June	52
July	47
August	68
Sept.	84

Since moisture use, especially during June, July, and August does not exceed two inches at least 50 percent of the months, crops will either consume previously stored moisture or contribute to a moisture deficit.

Growing Season

The growing season extends from late April until early October. The length of the frost free period (32°F) varies from 90 days to less than 75 days. The longest frost free period occurs in the southwest corner. The rest of the area has frost free conditions that extend on the average from mid-June until late August or September. Depressional areas are considered to be frost prone. The number of frost free days are expected to decrease to less than 75 in the Clear Hills.

Since feed grains do not suffer serious damage unless temperatures are 28°F or lower, the effective frost free period is lengthened for these crops.

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[4] Meteorological Branch, Department of Transport Monthly Records, Meteorological Observations, 1960-1969.

The number of growing degree days over 42°F varies from in excess of 2000 to less than 1800. Eighteen hundred to 2000 degree days over 42°F is considered the minimum necessary for agriculture; however, since degree days are calculated independent of day length, it is expected that the longer day length found in the study area will reduce the number of degree days required for successful agriculture to 1800. Areas with less than 1800 degree days are still suitable for pasture and hay crops.

Effect of Climate on Future Agricultural Development

Most of the study area is suited to feed grain and forage crop production with wheat production possible in the best areas. Grass seed production and livestock enterprises are possible. The best climatic conditions for agriculture are found in the southwest corner and these conditions decrease towards the north. The Clear Hills and depressional areas are considered unsuited to general agricultural use, but these areas could provide pasture.

GLOSSARY OF TERMS

Climate - The prevailing weather conditions of an area as determined by meteorological measurements made over a period of years.

Microclimate - The climate and its characteristics over a small area.

Frost free period - The period of time between the last spring frost (32°F or less) and first fall frost (32°F or less).

Killing frost - Any frost of sufficient severity to cause cessation of growth. A temperature of 28°F or less is considered sufficient to end the growth of most field crops.

Degree days over 42°F (growing degree days) - An index obtained by combining the length of the growing period with mean daily temperature to provide a cumulative measurement of the growing period. eg. mean temp. = 60°, 60-42 = 18 degree days.

Root Zone - The layer of soil in which plant root development will occur. Depth of this zone will vary but generally good agricultural soil will have a minimum of 3 or 4 feet of soil available for root development.

Soil moisture storage capacity - The amount of plant available moisture a soil can retain after gravitational drainage occurs. Generally it is measured in inches of moisture per foot of soil.

Plant available moisture - The moisture a plant can extract from a soil after gravitational drainage (1/3 Bar tension) and before the plant permanently wilts (15 Bar tension).

Moisture deficit - The difference between the amount of moisture available for consumption and the amount of moisture that could be consumed if it was available.

Moisture surplus - Moisture in excess of what can be consumed; therefore, can either be lost or stored for future use.

Potential Evapotranspiration - The amount of water used by evaporation from the soil and transpiration from the plants when there is a dense cover of vegetation and continuously moist soil. Simply, it is an estimate of water need.

GROUNDWATER - CLEAR RIVER STUDY AREA

This area is one of rather limited groundwater potential. The bedrock formations covering most of the area are marine shales yielding virtually no groundwater.

The lowest aquifer is the Dunvegan Formation, consisting of soft fine sandstone, siltstone, shale and coal. Thickness in the study area is about 500 feet. Its depth is almost beyond economic reach in certain areas, but it generally yields sufficient water for farm use. Wells to the Dunvegan would be some 200+ feet deep in most areas.

The Kaskapau Shale has no groundwater potential. The Badheart Sandstone, present along the northern periphery of settlement, is a five to ten foot thick iron-rich sandstone layer. Its groundwater potential is limited to supplies barely adequate for farm use. Quality is extremely poor also because of its high iron content. This formation underlies the entire Clear Hills area, and therefore is present mainly in areas not suited to agriculture.

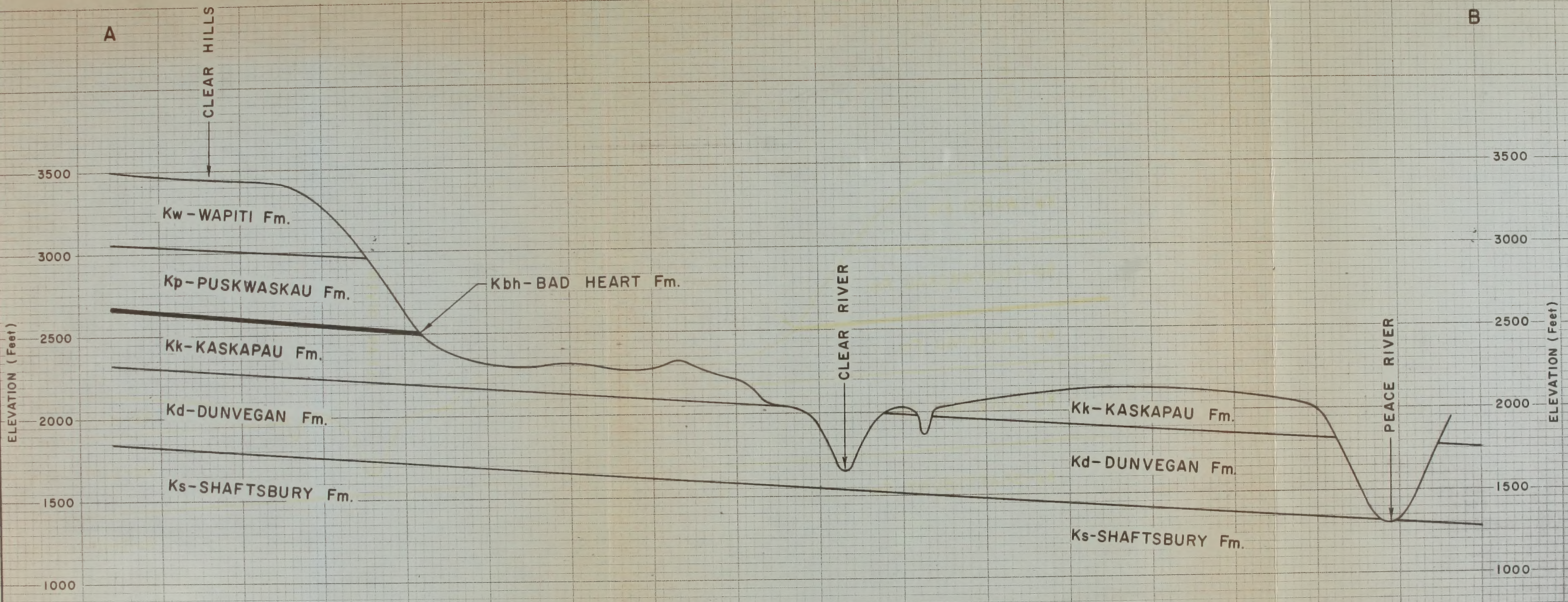
The Puskwaskau Shale lies between the Badheart Sandstone and Wapiti Formation. It has no groundwater potential.

The Wapiti Formation occurs in the upper part of the Clear Hills. It consists of lenticular sandstone, shale, and coal, and is the best bedrock aquifer in the Peace River district. Yields of 60 gallons per minute are known near the British Columbia border. Once again, it is present mainly in the area least suitable for agriculture.

A large area of terrace gravel is present in a four to six mile wide strip along the northern margin of Peace River. This gravel is up to 100 feet thick. Several wells, drilled by the Water Resources

Division, have penetrated this gravel and found it to be completely dry. The presence of this thickness of gravel renders drilling through it into the underlying bedrock formations very slow and expensive. No other surficial aquifers of any consequence are present in this area.

In summary, the best chances for adequate groundwater supplies are in or near the outcrop area of the Dunvegan Formation or of the Wapiti Formation. In the case of the former, the well owner should be prepared to drill several hundred feet, as the best aquifers of the Dunvegan are near its base.



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ALBERTA DEPARTMENT OF AGRICULTURE
WATER RESOURCES DIVISION
SOILS, GEOLOGY AND GROUNDWATER
BRANCH

CLEAR RIVER

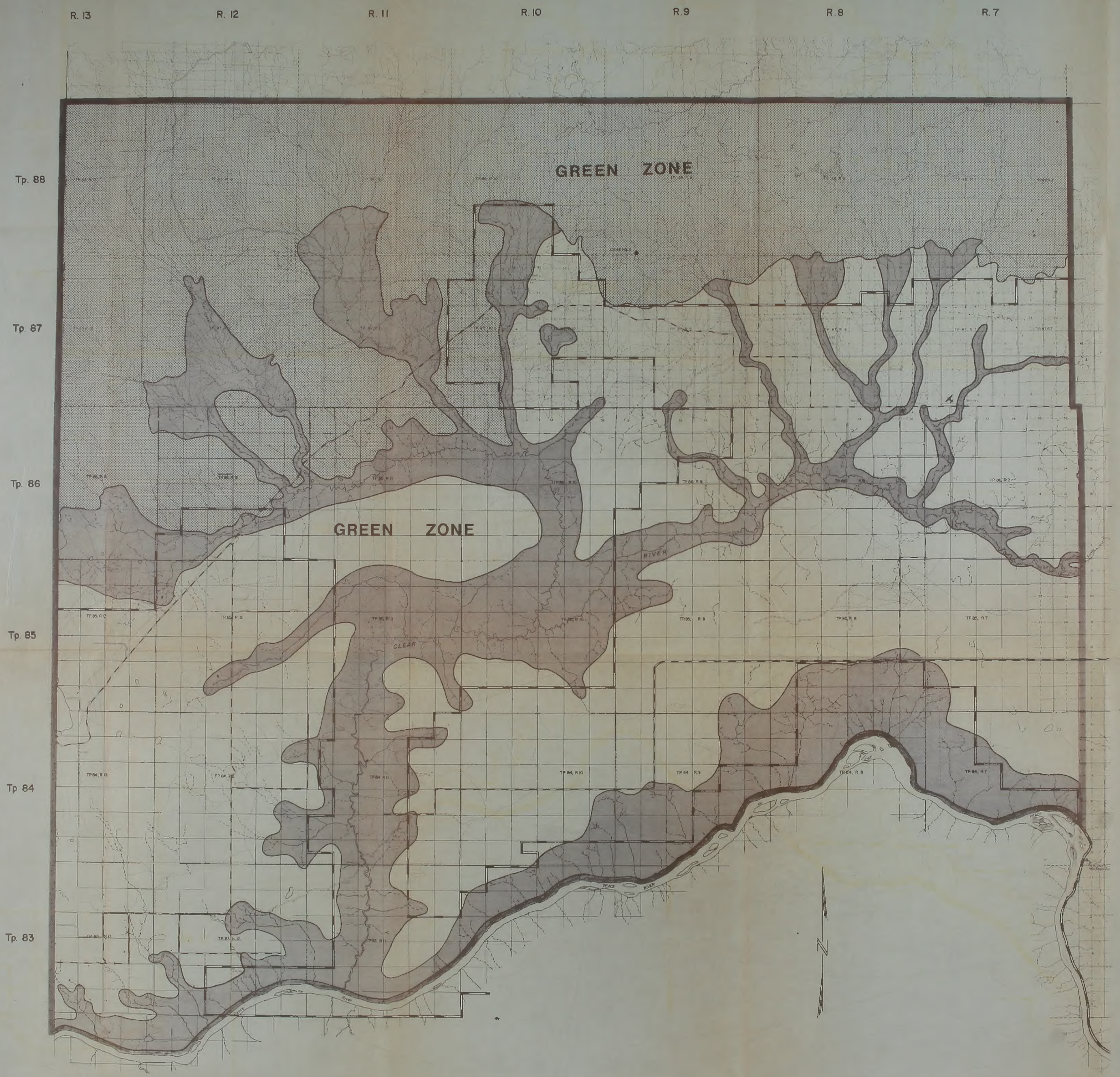
SECTION A-B

Scale: HORIZ. 1 in.= 2 mi.
Date: FEB. 1971
Sheet: 1 of 1

Submitted by: Branch Head
Date:
Approved by: Chief Engineer
Date:

Designed by:
Drawn by: I. G. LUKNAR
Checked by:

File No.



CLEAR RIVER

WEST OF THE SIXTH MERIDIAN

WATER RESOURCE MANAGEMENT

— LEGEND —

PRESENT GREEN ZONE BDRY. — - —
PROTECTION AREAS:
  River Break. ▨
  Area of marked relief susceptible to erosion. ▩

ALBERTA DEPARTMENT OF AGRICULTURE
WATER RESOURCES DIVISION
LAND DEVELOPMENT
BRANCH

WATERSHED PROTECTION AREAS

Scale 1 inch = 2 miles Date March, 1971 Sheet 1 of 1

Submitted by ______ Branch Head
Date ______
Approved by ______ Chief Engineer
Date ______

Designed by
Drawn by D. THRUSSELL
Checked by

File No.

~~MAR 22 '79~~

JUN 8 1976